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AUTHOR Humes, Ann

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ABSTRACT

This description of an interactive instructional computer program in sentence combining for upper elementary and middle school students begins by summarizing the content of the program, which focuses on the instructional technique in which students are given two or more short simple sentences to combine into one longer, complex and/or compound sentence. An outline of the four lessons presented by the program--coordinate predicates, coordinate adverbs and predicate adjectives, coordinate direct objects and predicate nominatives, and three kernel sentences containing the syntactic structures presented in the first three parts--is followed by a description of the structure of the individual lessons, including branching that occurs in response to student answers and the procedures that terminate the program. A discussion of some of the problems involved in developing highly interactive instruction for teaching composition on a microcomputer, and a list of nine references conclude the paper. (LMM)

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COMPUTER INSTRUCTION ON SENTENCE COMBINING

Ann Humes

ABSTRACT

An interactive computer program for providing instruction in sentence combining for upper-elementary and middle-school students is described. The content of the program is summarized. Then instruction and practice are outlined, as well as procedures that terminate the program. Finally, problems in developing highly interactive computer-based instruction are discussed.

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Ann Humes

Computer-based instructional resources for teaching composition are generally limited to the component skills of writing, such as punctuation and capitalization. Hardware and software limitations have precluded the development of computer instruction requiring actual composing activites. Only relatively recently have equipment developments enabled designers and developers of instruction to produce programs that involve the student in actual text manipulation and production. Advances include programs that allow students to select previously written story segments and form them into a story to be printed (referenced in Shostak, 1982); programs that allow students to input elements of discourse that the computer rearranges into a complete product (Marcus, 1982); programs that guide students in generating ideas for composing (Burns & Culp, 1980). Still other programs, devised as text-editing software, teach rewriting and editing (1) by evaluating users' input for such features as spelling, punctuation, grammar and (2) by reporting on users' sentence length, sentence type, and number of passive verb phrases (e.g., Cohen, 1982; Frase, MacDonald, Gingrich, Keenan, & Collymore, 1981; Miller, Heidorn, & Jensen, 1981).

Still inadequate is the number of programs that both teach the principles of composing and evaluate actual text that students input in response to computer-presented instruction. However, a program has now been developed that exploits the computer's potential to perform these tasks for upper-elementary and middle-school students. This paper

describes that program. The paper first discusses the content of the program. Then it outlines the mainline instruction presented after students input their names, which the computer uses to address the student throughout the instructional period. This section also describes the corresponding branching that occurs in response to students' performance on the tasks. In the next section, the paper explains the procedures that terminate the program. The final section discusses some of the problems involved in developing highly interactive instruction for teaching composition on a microcomputer.

CONTENT

The content of this interactive program is sentence combining. Sentence combining is an instructional technique employed to enhance students' syntactic fluency and versatility (e.g., Lawlor, 1980, O'Hare, 1973). Students are given two or more short, simple sentences that they combine into one longer, complex and/or compound sentence. Students may begin with simple coordinate combining as, for instance, in the following sentence-combining item:

The winning team ran onto the field. The winning team lifted the pitcher into the air.	Combine with "and."

The winning team ran onto the field and lifted the pitcher into the air.

Students involved in practice on combining proceed through items entailing simple structures to more complex combinations completed by subordinating and embedding elements of one sentence into another sentence.

Sentence combining was selected for the current study of composition instruction with the computer because it is based on a solid research foundation and because certain constraints make it amenable to computer-based instruction. For example, the expected output can be specified so that developing an algorithm for evaluating student text is feasible. Moreover, most students have had little experience with computers or with their word processing features accessed to input text. Therefore, relatively straightforward content is appropriate for initial instruction.

The current program contains four lesson parts. These parts differ either in the syntactic structures focused on or in the number of sentences to be combined. The four parts teach the following constructions:

Part A: Coordinate predicates, e.g.,

Tom fell to the ground.
Tom ripped his uniform.

Tom fell to the ground and ripped his uniform.

Part B: Coordinate adverbs and predicate adjectives, e.g.,

Earthquakes often strike suddenly.
Earthquakes often strike violently.

Earthquakes often strike suddenly and violently.

Part C: Coordinate direct objects and predicate nominatives, e.g.,

Peter is my friend.
Peter is my neighbor.

Peter is my friend and neighbor.

Part D: Three kernel sentences, comprised of the syntactic structures presented in Parts A-C, e.g.,

The ticket agent was friendly.
The ticket agent was helpful.
The ticket agent was patient.

The ticket agent was friendly, helpful, and patient.

Focusing on such relatively simple content for Lesson 1 is purposeful: It allows students to become familiar with both computer use and the sentence-combining techniques. However, content for later lessons is increasingly more complex. The complete scope of and sequence for the remaining eleven lessons are specified by Lawlor (1981).

INSTRUCTION

After first displaying a title screen, the computer requests that students type in their names. The name is then filed for use throughout the lesson.

For each part of the lesson, students are first given instruction on combining sentences to create a specific syntactic structure. While the screen displays the kernel sentences and the combining cue, instruction explains the combining cue, referred to as a "joiner," and briefly guides the students through the process: writing the words in the first sentence, but omitting the period; then adding the joiner, and writing the non-repeated elements of the subsequent kernel(s). An arrow flashes in the margin to guide reading and to direct students' attention to the example being constructed. Other elements that flash at appropriate points during the instruction are the joiner and the set of repeated words in the kernel sentences.

Students are then informed that they will combine some sentences and that they should check their answer sentence for punctuation, capitalization, and spelling before pushing the return key. The subsequent practice item consists of kernel sentences to be combined in the same way as the instructional example was combined. After students type in their answer and push the return key, the computer branches to evaluate the students' response.

The computer evaluates the response in a sequence of steps, branching where necessary for additional instruction or looping back to an earlier point in the evaluation if students change their response. First the computer checks for a capital letter at the beginning of the response. If there is no capital, the computer asks students to change the first letter to a capital. If students do not change the letter, the computer branches to the Syntax Routine to present the correct answer and then a new example and new practice item. However, if students have been presented a third example and still do not input a correct response, the computer terminates the lesson.

If the sentence has a capital letter, or if students change the first letter to a capital, the computer checks for a period at the end of the sentence. If no period is found, the computer asks for a period to be added. If students do not add a period, the computer branches to the Syntax Routine, as described above.

The computer then checks for the combining cue or cues, and, if missing, asks students to insert the cue(s) in the correct place. If students do not add the cue(s), the computer branches to the Syntax Routine described above.

If the sentence contains the cue or cues, the computer checks the sentence for the correct number of words. If the number of words is less than the correct number, the computer displays the following message:

> I am having trouble with your answer. Have you left out any spaces or words? Please fix your sentence. Then push the RETURN key.

If, however, the number of words is greater than the correct number, the computer displays this message:

> I am having trouble with your answer. Have you put in any extra spaces or extra words? Please fix your sentence. Then push the RETURN key.

If students make the correction, the computer again checks the sentence for the correct number of words. If the number is still not correct, or if students do not make changes, the computer branches to the Syntax Routine described above.

The computer then checks each word for spelling, accepting words with an adjacent extra space. For each mismatch, the computer displays the following screen:

> Are you sure you mean to write ? Check the sentences at the top for the correct way to write the word. Please fix the word. Then push the RETURN key.

If the mismatch is a spelling error and students do not correct it, the computer corrects the word if it meets the criteria of the spelling algorithm. Spelling errors checked by the computer include inappropriate punctuation marks adjacent to a word, doubled/non-doubled letters, transposed letters, a for an and vice versa, one missing

letter, one extra letter, one wrong letter, and inappropriately capitalized or uncapitalized words other than proper nouns and the first word of the sentence.

If the mismatch is not a spelling error and students change the answer, the computer loops back in the evaluation procedure to the point at which it checks the sentence for a period at the end. However, if the mismatch is not a spelling error and if students do not correct it, the computer branches to the Syntax Routine described above.

When the response has been successfully processed through all the evaluation steps described above, the computer provides positive reinforcement for the correct answer and presents another practice item unless the student has completed three correct responses. In that case, the computer provides instruction on a new combining procedure.

TERMINATION

Under certain circumstances the computer terminates the lesson. As previously noted, if students have been branched through a third example and still do not input a correct response, the computer terminates the program. The computer also terminates the lesson if students' operating time is close to twenty minutes and the computer is about to branch to the Syntax Routine, to another practice item, or to instruction on a new combining procedure. Termination also occurs, of course, when students have completed the entire lesson.

CONCLUSION

Programming even such "simple" content as sentence combining is far from easy. Once computers are dealing with natural language,

programming becomes far more complex than it is for multiple-choice instruction, particularly since the number of possible responses is enormous when students are permitted to type in their own responses. Instructional designers are then confronted not only with the problems involved in accounting for all possible student answers, but with the programming difficulty caused by limited microcomputer memory as well. For example, original specifications included visually exciting graphics to present the combining procedures. However, it was discovered that programming these graphics would use up too much memory; the remaining memory would not then accommodate actual student practice.

Because memory limits are quickly exceeded, designing a means for checking a sentence to verify that it has the right components posed serious programming problems because the computer could not do a comprehensive word-for-word match for all syntactic possibilities. Consequently, another means of checking for the appropriate sentence structure had to be devised. Checking for the combining cue is one part of the chosen strategy; counting words is another.

Enormous problems were also caused by the spelling check since spelling errors in any kind of word had to be defined. Thus an algorithm had to be devised for word features so that the computer could determine whether a student's sentence contained a spelling error.

In addition to accommodating the stringent demands of programming to check a student response, the program design had to address other concerns. Because students need to edit text to correct their own responses, a text-editing system had to be developed as part of the

program. This system complicated programming and used up memory. The design also had to consider such contingencies as students not pushing return when they are supposed to, students typing partial answers, and students refusing to type at all.

Despite the programming problems it posed and despite the fact that this instructional program is much simpler than that originally specified, the developed system is a highly interactive program. The instruction has been programmed and is operating, and it has been successfully piloted with the appropriate audience of users. Given sufficient user interest and sufficient resources, a complete program of sentence-combining instruction could be developed, thus employing the full capabilities of computers in higher-level composing activities.

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